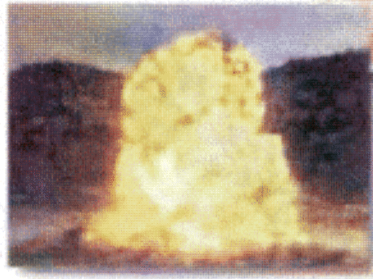


High Explosives Training Program

A leader in energetic materials research, development and, testing.



Program Description

The purpose of the High Explosives (HE) Training program is to revitalize the high-explosives engineering and manufacturing technical knowledge base at the Laboratory. This skill set has dwindled because of a decade of inactivity in refreshment of a stockpile that was built on a continuous 10 to 20 year cycle. Within the Engineering Sciences and Applications Division, the Weapons Materials and Manufacturing (ESA-WMM) group, is responsible for processing, fabricating, and disposing of energetic materials used in the nuclear weapons program. Each year the group makes roughly 1500 high-explosive components for research and development and test programs. The technical staff and mechanical technician workforce responsible for making these components is nearing retirement, and there is an urgency to maintain this critical skill. Without immediate and precise intervention, this critical skill will be lost to Los Alamos. There still exists the opportunity to utilize those nearing retirement in building a training program and mentoring the future generation of high-explosives engineers.

While the work force is aging (the average technician is 45 years old), the programmatic need for the development of high-explosive components to support the nuclear weapon SLEP (Stockpile Lifetime Extension Program), stockpile management, and fundamental research is growing. In the next five years, ESA-WMM expects to hire four to six high-explosives technicians and three to four high-explosives engineers. The talent to fill these processing positions exists in area universities, vocational training programs, and other educational institutions, but there does not currently exist a program in which this talent can be trained before prospective employees are on the job. The

objective of this program is to recruit these individuals to Los Alamos and rapidly train them to become contributors to the weapons program.

The current focus of this program is for newly hired and upcoming new hires on the high-explosives team to become trained in the characteristics, handling, processing, manufacturing, and disposal of energetic materials. It is hoped that this effort, with the support of local educational institutions, will soon provide programs that will award educational degree programs for individuals interested in the various aspects of energetic materials.

The program is currently targeted toward individuals that have already been hired by the Laboratory. Those interested must have at least a high school degree and some college work in physics and chemistry. We are working with New Mexico Tech in getting some of our employees involved with their new master's degree in explosive engineering through the Mechanical Engineering Department. There are also plans to develop a doctorate degree in energetic materials within the same department in the near future.

A very critical program we are also working toward is a certificate or associate's degree in high-explosive handling and processing. This program is being developed through the Mining Engineering Department at New Mexico Tech. New Mexico Tech operates the internationally known Energetic Materials Research and Testing Center (EMRTC). This facility is known for their anti-terrorist work with explosives. EMRTC is currently building facilities in Socorro, New Mexico, to house equipment and machinery for the manufacturing and processing of high explosives. ESA-WMM is currently gifting to EMRTC several pieces of equipment to be used for this purpose through a Laboratory Educational Equipment Gift (LEEG) agreement. As other Laboratory equipment is replaced or becomes obsolete for our needs, EMRTC will have the opportunity to receive future pieces of equipment for high-explosive processing. EMRTC will then have the ability to train individuals in high-explosive machining, and the Laboratory will be able to offer these individuals employment opportunities.

The current opportunities with New Mexico Tech have been advertised within the ESA and Dynamic Experimentations Divisions. We had hoped to start with a small population to first work out the problems with distance education. Word spread rapidly to Lawrence Livermore National Laboratory (LLNL), Pantex, and DOE, and we now have over one hundred interested individuals. Once other programs are fully developed, we expect more participation from

technicians and in other areas of the Laboratory. So far, word-of-mouth and e-mail have been the only advertising methods used.

Performance Objective and Milestones

Our main goal, which can be divided into two main objectives, is to re-establish Los Alamos as the technical knowledge base for the engineering and manufacturing of high explosives. First, we wish to train newly hired chemical and mechanical engineers in the field of HE engineering and manufacturing. New Mexico Tech currently offers a graduate degree in high explosives engineering that may be tailored to the needs of the DOE nuclear weapons program. A similar program is currently taking place at Sandia-Albuquerque through their Weapons Intern Program. With a combination of New Mexico Tech classes, some Sandia weapons classes, and some of our own classes taught by valuable members of our staff, it would be possible to award a degree program or a certificate through New Mexico Tech that would show that the graduate had the needed knowledge to "*hit the floor running*" once the program is completed. New Mexico Tech students already involved in the graduate program may also be recruited and trained as high explosives engineers in a program tailored to the needs of Los Alamos and the weapons program.

The second objective for the program is the development of an associate's degree or certificate in high-explosives manufacturing from which the Laboratory and DOE complex can recruit vocational graduates to support the manufacture of research and development parts. There are many machinist-training programs, but there are no formal apprentice programs in the field of high-explosive safety, pressing, casting, machining, inspection, and disposal. Other facilities, such as the Naval Air Warfare Center, are watching our progress in this area with great interest, as they are facing the same attrition problem. The gifting of our excess equipment

will allow EMRTC and New Mexico Tech to develop classes to support these skills.

Milestones Proposed and Met this Year

- Formation of a steering committee from the Laboratory and New Mexico Tech. This committee began meeting in April 2001, and meets about every two months.
- Curriculum finalized. Various curricula have been proposed and discussed, but none have been finalized because we are not confident of the support we will receive. Management seems to be concerned with time commitments for both students and instructors. Therefore, we have currently decided to continue with a few classes at a time. New Mexico Tech does not require a commitment to a degree program until after twelve credit hours have been taken.
- Students, mentors, and instructors identified. We have identified over one hundred students and instructors for two classes that will be taught in the spring by New Mexico Tech.
- Distance education media operational. With the tremendous help of HR-6, we know that we can effectively and efficiently communicate with New Mexico Tech through video conferencing.
- Development of a safety course with EMRTC. The curriculum of a safety course with the help of EMRTC was developed, and the course was given in late September. Two days of instruction were given at the Laboratory with the help of our "*forefathers*," such as John Ramsay and Bill Davis, followed by two days at the firing site at EMRTC with a series of hands-on fieldwork. Twenty people from the Laboratory attended, as well as one local high school teacher.
- Donation of processing equipment to New Mexico Tech through the LEEG Program. EMRTC personnel were brought to the Laboratory to select desired equipment. All Laboratory paperwork has been completed. Equipment is currently being prepared for removal and transportation to EMRTC.

ESA-WMM plans to take a proactive approach to staffing the R&D manufacturing line for the coming years by partnering with NM Tech in building graduate, undergraduate, and associate's-level degree programs. Science-based stockpile stewardship requires the transfer of decades of experience and knowledge to a new generation of scientists and engineers who can apply new tools and technology. Stewardship of the manufactured high-explosive components requires a thorough understanding of what was proven through testing and the processes used to make them at Los Alamos.

The high-explosive components certified through a series of underground tests, hydrotests, and mechanical tests were manufactured at Los Alamos. Coincident with performance questions, there are increasingly more difficult questions being asked about the safety of explosive components for weapon systems under extreme conditions. These questions can only be addressed if the scientific expertise is transferred from the original explosives engineers to a new generation of engineers. What took a career for the present engineers to understand must be transferred in a few short years. The time is too short to pass the torch through on-the-job training, so a formal education approach is necessary to revive this critical skill. When established, LLNL and Pantex could utilize this educational program for staff development and recruitment as well. DP-sponsored research in shock physics will also benefit from this program.

This program addresses at least two of the Critical Skill Areas for Stockpile Stewardship: #4, Materials Science and Technology, and Critical Skill Area #6, Manufacturing. More specifically, the program outlined will provide special expertise in HE, including mechanical and thermal characterization, as well as compatibility issues, weapons materials processing, fabrication, testing and evaluation, and increased knowledge in HE safety and performance testing and analysis. There will also be the development of expertise in the areas of manufacturing

process development, component fabrication, inspection, and assembly. The education will focus specifically on explosives used in the DOE complex and fielded nuclear weapons. The advanced degrees will also develop an expertise in other critical knowledge areas such as shock and detonation physics (Skill Area #2) and design, fielding, and execution of dynamic experiments (Skill Area #7).

Highlights of This Year's Accomplishments

This program did not get underway until April 2001. Since that time we have established a distance learning committee with New Mexico Tech, which also includes an interested member from Livermore. We have support from division management and from HR-6. We are determined to make this program a first-class operation.

We developed and presented with EMRTC a safety course on high explosives. Two other

groups [Dynamic Experimentation firing site teams and NESS (Nuclear Explosives Safety Study)] are currently requesting that we develop and deliver a similar course for their organizations, with an emphasis on their interests and needs.

Two classes offered by New Mexico Tech next spring have been advertised within two divisions at the Laboratory with tremendous response. We are also trying to determine if our distance education facilities will also support Livermore and the Nevada Testing Site as well.

We are in the process of donating over \$300,000 worth of equipment to EMRTC to establish a center for high-explosive manufacturing and processing training. Other equipment should become available in the future as we replace some of our presses.